

A NOTE ON THE IDENTIFICATION OF PLANT REMAINS
IN SANDROCK NEAR EVANS HEAD, N.S.W.

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(Plate vi.)

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Synopsis.

Specimens of wood from a coastal sandrock deposit near Evans Head, N.S.W., were identified as belonging to two genera, *Agathis* and *Eucalyptus*. The criteria of identification are described.

Since *Agathis* is not found naturally in New South Wales the significance of this occurrence is examined in relation to the distribution and habitat of present-day communities in Queensland.

Various workers (*see* David, 1950) have recorded the occurrence of plant fossils in the coastal sediments of Quaternary age in Eastern Australia. Usually these fossils are similar to plants now living in the area, a not unexpected finding in view of the wide range of growth conditions of many of these species.

At the Gap near Evans Head, N.S.W., coastal sandrock deposits contain an abundance of humified roots and aerial parts, particularly in the surface and subsurface of the beds. The identification of this fossil plant material was initially undertaken to provide indirect information on the environment at the time of sandrock formation.

Most of the material revealed structural properties of the Kauri pine genus, *Agathis*, which does not now occur naturally in N.S.W. The subject of this note, therefore, is a description of the specific characteristics of the material upon which the identification is based.

NATURE AND OCCURRENCE.

The sandrock at the Gap has already been described and the variability of the organic matter in content, and degree of decomposition, noted (McGarity, 1956). The less decomposed material in the upper portion of the sandrock frequently retains cell structure despite intense humification. This material comprises small roots up to 1 inch in diameter which can be removed by careful digging. Larger pieces of humified wood are occasionally found. These appear to be pieces of trunks and branches, and are more suitable for microscopic examination, particularly towards the interior of the specimens where decomposition is often less intense.

While it could be reasoned that much of the root and trunk material at the top of the sandrock may have been derived from vegetation growing above the deposit, the presence of roots and a large piece of vertically embedded wood, exposed on a wave-cut platform at a point 7 feet below the upper surface, leaves no doubt that this material at least was covered by the continued development of sandrock, either after or at the same time as growth. The large woody specimen, designated specimen A, is shown in Plate vi, figure 1.

This material was used for the description given below. Many other, more decomposed specimens above this level were examined microscopically, but these did not appear to differ appreciably, with one exception, from the described specimen.

The one exception, specimen B, from the upper surface of the sandrock is also described.

DESCRIPTION OF THE PLANT REMAINS.

Method of Examination.

As the samples were extremely fragile in the dry condition, they were soaked in glycerine and transverse, tangential longitudinal, and radial longitudinal sections prepared by hand with a safety-razor blade. These sections were mounted in glycerine and examined with microscope magnifications of 120 and 600.

Specimen A.

The large piece of wood from the 8 ft. platform (Plate vi, figure 1) had the field appearance of a tree stump. It was somewhat flattened with maximum dimensions of 14 in. in height \times 12 in. \times 5 in., with a tendency for division at the base (roots?). The wood was highly humified, dark brown to black in colour, very soft and fibrous, and fragments broken away with the fingernail left a woolly surface.

Under the microscope, the vertical wood elements were found to be tracheids. These were somewhat rounded in transverse section with thicker walled cells forming indistinct growth rings (Plate vi, figure 2).

In longitudinal section (Plate vi, figures 3, 4) the wavy walls of these tracheids were crowded with up to three rows of alternate, bordered pits and showed numerous resin plugs. In several sections all tracheids were blocked.

Uniseriate ray parenchyma up to 12 cells in height and numbering approximately 31 per sq. mm. showed distinct cross field pitting in radial section (Plate vi, figure 3). These pits, 2 to 9 per crossing, had oblique orifices. Ray tracheids were not observed. The ray cells contained abundant dark deposits which could have been resin, but the sections were extremely dirty, due to breaking away of fragments of cell walls, making positive identification difficult.

The major features of identification consist of the simple, basic wood structure of tracheids (Gymnosperm) with crowded, alternate pitting, the absence of resin canals and indistinct growth rings. This is typical of the Araucarineae. According to Dadswell and Eckersley (1935) it is possible to differentiate *Agathis* and *Araucaria*. members of this subfamily, by means of the wood structure. While species of *Agathis* can contain frequent or infrequent amounts of resin as plugs in tracheids, resin plugs are apparently always infrequent in *Araucaria*. The presence, therefore, of numerous resin plugs indicates that the humified material is *Agathis*.

The heavy deposits of resin in the specimen may in some way be related to a finding that conifers growing on peaty soils have increased accumulations of resin compared with those grown in normal situations (Anon., 1932).

It is impossible to identify to the species level with certainty, due to the decomposed nature of the material. However, the rays do not exceed 12 cells in height, which is a characteristic of *Agathis robusta* F.M.B. A microscopic comparison of sections of the humified material with authentic *A. robusta* showed almost identical features.

Root-like fragments from the 8-ft. level and above, although more decomposed, were structurally similar to the material described. The one exception already noted is described.

Specimen B.

This material from the upper surface of the sandrock was roughly rectangular, $3\frac{1}{2}$ in. \times $\frac{1}{2}$ in. and barely $\frac{1}{4}$ in. thick, dark brownish-red in colour with distinct grain markings.

The vertical wood elements comprised parenchyma, vessels and wood fibres. The parenchyma cells were abundant and diffusely arranged with the moderately thick-walled resin-free wood-fibres. The vessels showed solitary arrangement with an average frequency of 9 per sq. mm. They were 150-300 microns in diameter and contained well developed tyloses.

Uniseriate, biseriate and triseriate arrangements of the squat ray cells were seen in radial section, the triseriate making up 15 per cent. of the rays. The frequency of the ray parenchyma was 33 per sq. mm., but many of these were collapsed and

broken and the estimate is probably low. Cells of both xylem and ray parenchyma were filled with resin deposits.

The material showed the typical structure of *Eucalyptus* sp., the features of triseriate rays, paratracheal parenchyma, resin-free fibres and long rays would indicate, according to the classification of Dadswell and Burnell (1932), either *E. grandis* (W. Hill) Maid. or *E. saligna* Sm. Comparison with microscopic sections of these woods showed a close similarity.

PRESENT DISTRIBUTION OF AGATHIS.

Although it was impossible in both examinations to identify the exact species from the wood, the identification of the genus *Agathis* is itself of interest. No living representatives of this genus are known in New South Wales but three species are found to the north in Queensland. This indicates a southern extension of the genus during Quaternary times.

Of the three Queensland species, viz. *Agathis palmerstonii* F. v. M., *A. microstachya* and *A. robusta*, Mr. L. S. Smith, of the Botanic Gardens, Brisbane, has supplied the following information.

"*A. palmerstonii* and *A. microstachya* do not occur south of the Herbert River near Cardwell. Both of the above species grow in rain forest on the ranges and tablelands on well drained soils, usually associated with granites. Although occurring at altitudes of about 2,000 ft. or more, *A. palmerstonii* will occasionally follow the rivers down to about 250 ft.

"*A. robusta*, however, does occur in a type of rain forest on deep sandy soils between dunes only a few miles from the sea on the mainland just south of Fraser Island and probably in similar habitats on the island itself. These soils are porous and well drained, but presumably the roots are able to reach the water table. Free water does not occur at the surface."

It would appear, then, on the basis of habitat and distribution, that the tree stump and other remains are probably those of *A. robusta* communities which became established during periods when the peat swamps, from which the sandrock was formed (McGarity, *op. cit.*), were freely drained.

The absence of living *Agathis* from New South Wales suggests a retreat of the species possibly during the arid Recent period. Its failure to re-establish under the improved (?) present climatic conditions further suggests that in S.E. Queensland it may be a relic community surviving only in the most favourable situations.

The presence of *Eucalyptus* remains on the surface of sandrock could be the consequence of a change in the environment with invasion or replacement of the *Agathis* community, or merely material of more recent origin which may have penetrated the sand layers overlying the sandrock.

It is evident that the plant remains in this sandrock deposit are worthy of more intense investigation. The information obtained would no doubt shed more light on the environment of this period of Quaternary time, particularly if the age of the sandrock can be established with certainty by radiocarbon dating.

References.

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EXPLANATION OF PLATE VI.

- 1.—Fossil wood (*Agathis*) on wave-cut platform, Evans Head, N.S.W.
- 2.—Transverse section of fossil *Agathis* showing growth ring of tracheids.
- 3.—Radial longitudinal section of fossil *Agathis*. Pitting of tracheids and ray parenchyma.
- 4.—Tangential longitudinal section of fossil *Agathis*. Resin plugs in tracheids.

Figs. 2, 3, 4, × 60 approx.